

What is claimed is:

1. A system for accurately placing a bone engaging element in a bone comprising:

a working tool having a working end operable to place the bone engaging element into a bone;

a position tracking element connected to said working tool;

a localizing device operable to sense the position of said position tracking element as said working tool is moved and to generate a position signal in relation thereto; and

a processor connected to said localizing device to receive said position signal, said processor operable to compare said position signal to location information identifying a location on the bone for the bone engaging element and to generate an output signal when said position signal substantially coincides with said location information.

2. The system of claim 1, further comprising an annunciator connected to said processor and operable to generate a human sensible signal in response to said output signal from said processor.

3. The system of claim 2, wherein said annunciator generates an audible signal.

4. The system of claim 2, wherein said annunciator generates a visible signal.

5. The system of claim 2, wherein said annunciator is mounted on said working tool.

6. The system of claim 5, wherein said annunciator generates a visible signal.

7. The system of claim 1, wherein said working tool includes an on-board controller, said on-board controller connected to said processor and operable to control said working tool in response to said output signal.

8. The system of claim 7, wherein said on-board controller is operable to activate said working tool in response to said output signal.

9. The system of claim 7, wherein said working tool includes:  
a sheath configured to cover said working end; and  
a mechanism connected to said sheath to move said sheath to and from a position covering said working end,  
wherein said on-board controller is operable to control said mechanism in response to said output signal to move said sheath from said position covering said working end.

10. The system of claim 7, wherein said working tool includes:  
a mechanism connected to said working end to move said working end to and from an operative position in contact with the bone,  
wherein said on-board controller is operable to control said mechanism in response to said output signal to move said working end from said operative position.

11. The system of claim 1, further comprising a second position tracking element associated with the bone, wherein said localizing device is operable to sense the position of said second position tracking element to generate said location information.

12. The system of claim 1, wherein said working tool is a tool adapted to drive a pin into bone.

13. A method for accurately performing a procedure on a bone, comprising the steps of:
- determining a location on the bone for performance of the procedure thereon;
  - in real-time determining the position of the working end of a tool configured to perform the procedure on the bone as the tool is moved relative to the bone;
  - comparing the position of the tool to the location on the bone;
  - generating an output signal in response to the comparison when the position of the tool substantially coincides with the location on the bone; and
  - activating the tool in response to the output signal to perform the procedure on the bone.
14. The method of claim 13, wherein the output signal is a human sensible signal.
15. The method of claim 14, wherein the output signal is an audible signal.
16. The method of claim 14, wherein the output signal is a visible signal.
17. The method of claim 14, wherein the step of activating the tool is performed by the surgeon in response to sensing the output signal.
18. The method of claim 13, wherein:
- the tool includes an on-board controller operable to activate the tool in response to the output signal; and

the step of activating the tool occurs automatically in response to the output signal.

19. The method of claim 13, wherein the tool is a drill adapted to drill a bore in the bone.

20. The method of claim 19, wherein:  
the working end of the tool is a drill bit; and  
the step of activating the tool includes activating the drill bit to drill into the bone.

21. The method of claim 20, wherein the step of activating the drill bit includes automatically exposing the drill bit from a position in which the bit was prevented from contacting the bone.

22. The method of claim 13, wherein the tool adapted to drive a pin into the bone.

23. The method of claim 22, wherein the step of activating the too includes automatically activating the tool to drive the pin into the bone.

24. A method for placing a plate on a bone, comprising the steps of:  
determining a location on the bone for placement of a support pin;  
in real-time determining the position of the working end of a tool configured to place a support pin in bone as the tool is moved relative to the bone;  
comparing the position of the tool to the location on the bone;  
generating an output signal in response to the comparison when the position of the tool substantially coincides with the location on the bone;

operating the tool in response to the output signal to place the pin into the bone;

mounting the plate on the pin; and

placing the plate in a final position on the bone.

25. The method of claim 24, wherein the step of placing the plate in a final position includes:

pivoting the plate about the pin;

in real-time determining the position of the plate;

comparing the position of the plate to the location on the bone as the plate is pivoted; and

fixing the plate in the final position in response to the comparison when the position of the plate substantially coincides with the location on the bone.

26. The method of claim 24, wherein the step of placing palte in a final position includes:

determining a second location on the bone for placement of a second support pin;

in real-time determining the position of the working end of a tool configured to place a second support pin in bone;

comparing the position of the tool to the second location on the bone;

generating an output signal in response to the comparison when the position of the tool substantially coincides with the second location on the bone;

operating the tool in response to the output signal to place the second pin into the bone; and

mounting the plate on both pins.

27. The method of claim 24, wherein the tool includes a pin guide and a driving device configured for driving a pin into bone through the pin guide.

28. The method of claim 24, wherein the plate is a bone plate for fastening to the bone across a fracture in the bone.

29. The method of claim 24, wherein the plate is a cutting guide for use in resecting a portion of the bone and the final position is a position on the bone to perform the resection.

30. A system for accurately placing a bone engaging element in a bone comprising:

- a guide configured to guide placement of the bone engaging element at location on a bone; and

- a guide apparatus supporting said guide, said guide apparatus including;

- a support body mountable to the bone;

- a guide arm extending from said support body and configured to extend toward the location on the bone; and

- a position adjustment assembly supported on said guide arm and configured to permit gross and fine adjustments of the position of said guide relative to the bone in at least one degree of freedom.

31. The system of claim 30, wherein said guide is a pin guide and the bone engaging element is a pin configured to be placed in bone.

32. The system of claim 30, wherein said position adjustment assembly includes:

- a gross positioning block movably mounted on said guide arm to make gross position adjustments in one degree of freedom; and

- a fine adjustment block movably supported on said gross positioning block and operable to make fine position adjustments in said one degree of freedom, wherein said guide is supported by said fine adjustment block.

33. The system of claim 32, wherein said position adjustment assembly includes fine adjustment mechanism disposed between said gross positioning block and said fine adjustment block.

34. The system of claim 33, wherein said fine adjustment mechanism includes:

- a rack gear mounted to one of said fine adjustment block and said gross positioning block; and

- a thumbwheel gear configured to mesh with said rack gear and mounted to the other of said fine adjustment block and said gross positioning block.

35. The system of claim 32, wherein said position adjustment assembly includes:

- a support arm supported by said fine adjustment block;

- a second gross positioning block movably mounted on said support arm to make gross position adjustments in a second degree of freedom different from said one degree of freedom; and

- a second fine adjustment block movably supported on said second gross positioning block and operable to make fine position adjustments in said second degree of freedom,

- wherein said guide is supported by said second fine adjustment block.

36. The system of claim 35, wherein said position adjustment assembly includes a second support arm connected to said second fine adjustment block, wherein said guide is connected to said second support arm.